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Experiment Station Work, LXVIII.

Compiled from the Publications of the Agricultural Experiment Stations.

THE FEEDING OF A GRAND CHAMPION STEER.

THE UTILIZATION OF DAIRY BY-PRODUCTS AS FOOD.

JANUARY, 1912.

PREPARED IN THE OFFICE OF EXPERIMENT STATIONS,
A. C. TRUE, Director.

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[1] Director.

[2] Special agent in charge.

EXPERIMENT STATION WORK.

Edited by W. H. BEAL and the Staff of Experiment Station Record.

Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. TRUE, Director, Office of Experiment Stations.

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ILLUSTRATIONS.

EXPERIMENT STATION WORK.[1]

THE FEEDING OF A GRAND CHAMPION STEER.

Steers fitted and exhibited by agricultural colleges and experiment stations have won the grand championship at the International Live Stock Exposition at Chicago eight times during the past 12 years. More or less complete records have been kept of the methods of feeding these steers, and it is believed that the following compilation from these records and from accounts of Scotch methods of feeding cattle for exhibition will furnish some lessons of practical interest and value.

SHAMROCK, 1902.

The champion steer in 1902 was Shamrock, a grade Angus, bought by the Iowa Agricultural College when a calf, winning the championship as a 2-year-old. During the growing period he was not pushed rapidly, as a tendency to coarse bone indicated that he might become too rough. His feed consisted of roots and clover hay for roughage, cooked bran and ground oats, moistened oil cake and corn-and-cob meal. The last few months of the finishing period he was given all he could eat. Molasses water was used as an appetizer on the corn-and-cob meal and cooked mixture. At the time of the show Shamrock weighed 1,805 pounds and sold for 56 cents per pound.

CHALLENGER, 1903.

Challenger, the grand champion steer at the International of 1903, was a grade Hereford, purchased by the University of Nebraska in April for 5 cents per pound and shipped to Lincoln. He was put on a ration consisting of corn 50 per cent, oats 25 per cent, wheat bran 15 per cent, and linseed meal 10 per cent. He was also fed liberally on alfalfa hay and a small quantity of prairie hay. During the summer he was allowed the run of the grass pasture a few hours each day, but was given all of the grain mixture he would consume in connection with the pasture. In November he was given a few sliced beets. During the six months he made a gain approximately of 100 pounds per month and weighed about 1,750 pounds.

[1] A progress record of experimental inquiries published without assumption of responsibility by the department for the correctness of the facts and conclusions reported by the stations.

CLEAR LAKE JUTE 2d, 1904.

The grand champion steer at the International for 1904 was Clear Lake Jute 2d, a 2-year-old Angus, which was fitted for the show at the Minnesota Experiment Station. The methods of feeding and the weights of this steer from December 1, 1903, to October 11, 1904, are given in the following table:

Feed and weight records of champion Aberdeen-Angus bullock, Clear Lake Jute 2d, by periods.

	Dec. 1, 1903, to Jan. 4, 1904 (5 weeks).	1904			
		Jan. 4 to Mar. 28 (12 weeks).	Mar. 28 to June 28 (13 weeks, 1 day).	June 28 to Sept. 27 (13 weeks).	Sept. 27 to Oct. 11 (2 weeks).
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Corn	62.47	92.40	72.30	108.50	78.40
Bran	208.25	320.60	242.40	235.10	39.20
Oats	124.95	157.00	111.30	220.85	68.61
Peas				35.00	
Oil cake	20.82	30.80	27.60	33.95	9.79
Barley		25.20	110.40		
Hay	343.00	665.00	826.00	714.00	168.00
Pasture			(1)	(2)	
Roots	483.00	994.00	728.00	189.00	168.00
Corn fodder		266.00			
Live weights (initial)	1,620.00	1,620.00	1,685.00	1,710.00	1,790.00

[1] 5 weeks. [2] 10 weeks.

BLACK ROCK, 1905.

Black Rock, the champion in 1905, was a 2-year-old grade Angus purchased by the Iowa Experiment Station as a yearling. During the first month after his purchase he was kept in an open shed and fed ear corn cut into pieces about 2 inches long and mixed with a little bran. He was then turned into a pasture with other steers and fed soaked corn with some oats, bran, and cut hay. As the steers were not gaining fast enough at the end of three weeks the corn was cooked and barley and oats added to the ration. Corn fodder was given for roughage. Grain was given twice a day until June, when the steers were annoyed so much by flies that they were kept in a barn and fed three times a day with hay and pastured at night. At this time the grain mixture consisted of corn, oats, bran, flaxseed meal, and cottonseed meal. Black Rock received about 8 pounds of this feed at a time. The grain was cooked at night. This was continued until the middle of August. From that time until he was taken to the show he was fed four times a day, at 5 in the morning, 12 m., 5.30, and 9 p. m. He was kept out nights until October 1. After that he was kept in the barn the entire twenty-four hours except for a short walk for exercise before feeding in the morning. At slaughter Black Rock weighed 1,610 pounds, and dressed 69.97 per cent live weight.

FYVIE KNIGHT, 1908.

The feeding of Fyvie Knight, the grand champion steer of the International in 1908, exhibited by the Indiana Experiment Station, was described in the Chicago Farmers' and Drovers' Journal of December 2, 1908, as follows:

The steer came to the farm a thin bull calf, where he was castrated and turned in with other steers kept on the farm for instructional purposes. He has been on full feed about 10 months, and during the past summer ran on blue-grass pasture at night and during the early part of the day. As cooler weather came on he was turned on grass during the day and kept in at night. He has received a ration of bran, shelled corn, cracked corn, ground oats, wheat, silage, and clover hay. The ration used just before entering the show was bran one part, cracked corn three parts, shelled corn four parts (fed at noon), ground oats seven parts, cracked wheat one part, silage 1½ pounds per day, with light ration of clover hay. He had always been an excellent feeder, although somewhat nervous in the stall. Doubtless he reached his most perfect form during the show. This was his first year to show, and he had never been off feed and had never received an excessively heavy ration. His gain for the past six months was 300 pounds, for the month of November 50 pounds. * * * The steer was used by the agricultural students of [Purdue] university during the fall months to represent the best type of beef animal in the work of scoring and judging beef steers. He was kept on the farm primarily for instructional purposes, although he had been looked upon for the past year as a very promising show steer.

KING ELLSWORTH, 1909.

The Angus steer King Ellsworth, grand champion in 1909, was calved in Illinois September 6, 1906, and was finished at the Kansas station. Prof. R. J. Kinzer describes[1] his feeding and handling as follows:

From the time he arrived at the college farm, immediately after the close of the International in 1908 [where he had been shown as a yearling], until he left his principal roughness was alfalfa hay, and his grain ration was corn meal, bran, and oil meal. During the winter of 1908–9 he ran in an open yard during the day with the other steers that were being fitted for show, and at night they were stabled in a fairly comfortable shed. During the winter they were given a little corn fodder to pick at during the day and were fed grain only twice a day and then only a limited quantity, which was about equal parts of corn meal and bran. From about the middle of March until the middle of June a cooked or steamed feed was fed once a day. This food was prepared by cooking the corn a couple of hours in a large kettle. The water was then drained off and the corn was piled on the floor, covered with bran and chaffed alfalfa leaves. The heat from the corn steamed the bran and alfalfa, and it was allowed to remain in this pile until cooled, then the bran and alfalfa were thoroughly mixed with the corn.

During the early part of the season until the flies became bad the steers were turned on blue-grass pasture for a few hours each day, and during the fly season they were stabled during the day and allowed to run in a small blue-grass

[1] The Breeder's Gazette [Chicago], 56 (1909), p. 1370.

paddock at night. Plenty of exercise was given the steers during the entire year, they being required to walk 1 to 1½ miles per day.

There was neither sugar, molasses, nor drugs of any description used in the fitting of King Ellsworth. His official weight at the International of 1908 was 1,420 pounds. For fear of getting him too heavy he was never crowded to the limit. He was always a very hearty eater, always ready for his feed, and never during the entire year showed the slightest disposition toward being "mincy" about his eating or off feed, and was never at any time given all the feed that he would have consumed.

No accurate account was kept of just the amount of feed he consumed, but it probably would not be far from an average of 10 pounds of corn meal, 6 pounds of bran, and 1 pound of oil meal per day, with all the alfalfa he cared for. His official weight at St. Joseph in September was 1,660 pounds; at Kansas City, in October, 1,710, and at the International 1,750 pounds.

SHAMROCK 2d, 1910.

The method of feeding the grand champion steer of 1910, which was finished at the Iowa station, was as follows: The steer was dropped January 10, and in addition to a nurse cow the latter part of April was fed good clover hay and a grain ration of corn, wheat bran, and oil meal in the proportions of 3:2:1. September 1 he was given an additional nurse cow, although both foster mothers were weakening in milk. Roots and green cornstalks and ears were then added to the ration and the grain allowance was cut down somewhat. Boiled wheat and oats was given in place of the dry feed. The animal was then eating from 9 to 11 pounds of cooked feed, 25 pounds of roots, and 5 pounds of clover hay per day. In 205 days he gained 794 pounds, lacking only 26 pounds of being 4 pounds per day.

VICTOR, 1911.

Victor, the winner at the 1911 International, was a grade Angus, bred in Iowa. His sire, Keymura, was the junior champion Angus bull at the International when a 2-year-old. Victor was calved in January, 1909, and won the second prize as junior grade calf that year. The following March he was champion steer at the Fort Worth show, and Angus champion at the Iowa State Fair, and also first in his class at the American Royal Show at Kansas City.

He was bought by the Iowa Agricultural College October 15, 1910, weighing 1,100 pounds, a little light for his age. He was light in the quarters, a little down in the back, and beginning to get a little rough at the tail head. He showed such a tendency to "roll" over the loin that many judges pronounced him down at that time. He was put on a ration of boiled wheat and oats, mixed in equal parts, with a little grain, 2 or 3 pounds of roots, and plenty of clover hay. This was given three times a day and the amount limited only by the appetite of the steer. To keep up circulation and appetite he was given

a 2-mile walk every day. By the time of the 1910 International he weighed 1,238 pounds, showed first in his class, and was reserve champion yearling. The problem then was to keep a steer of his ripeness in the smooth condition demanded by a champion animal. He was shipped back to Ames and roughed through the winter, and twice a day was given what he would eat up clean of equal parts of shelled corn and bran, with a little corn meal. Clover hay was supplied as roughage and 3 or 4 pounds of silage was added as an appetizer. During the day he was turned out in the field, and as soon as grass came he was put on pasture. About May 1 he weighed the same as at the International. On the approach of hot weather he was left in a cool dark basement stall during the day and turned on pasture at night. About September 1 his ration was increased to three meals a day, the morning and noon meals consisting of equal parts of corn, oats, and bran. The afternoon feed was a boiled mixture of 3 parts oats, 1 part wheat, and 1 part peas. The grain ration was increased as fast as he would clean it up, and in addition he was given about 3 pounds of roots. As soon as green corn was fit to feed he ate all he could clean up at one feed in the afternoon. Though he showed signs of getting patchy, the soft-boiled feeds kept him in a smooth condition.

Early in October the number of feeds was increased to four a day, two meals being boiled feed, and all that the steer would eat was fed at a time. This plan was kept up for one week before the show, when the boiled feed was taken out of the ration to guard against shrinkage in shipping and showing. At the time of the show Victor weighed 1,670 pounds, a gain of 450 pounds since May 1. This gain of 2 pounds a day was not phenomenal, but was a good average for a steer that was supposed to be finished a year previous. He sold for 90 cents a pound and dressed 69.87 per cent of live weight.

The important part which the judgment and skill of the feeder plays in the successful handling and feeding of exposition animals is brought out with especial emphasis in the case of this animal. These were doubtless no less important in the other cases.

SCOTCH METHOD OF FEEDING ANIMALS FOR EXHIBITION.

The Scottish method of feeding cattle for exhibition is described[1] by W. J. Kennedy, of the Iowa station, as follows:

> The Scottish cattle feeders are not only very successful feeders of cattle for market purposes, but they are also unsurpassed in the feeding and bringing out of superb fat cattle for show purposes. At the leading fat-stock shows in Great Britain the cattle from Scotland invariably win the highest honors. While investigating the other lines of live-stock feeding, the writer also secured

[1] The Breeder's Gazette [Chicago], 48 (1905), pp. 268, 269.

some information pertaining to the methods of feeding practiced by the most successful exhibitors of fat cattle. In this line of work the greatest amount of attention is given to the feeding of 2-year-old cattle, as at all the leading shows there are no classes for fat calves, and the feeders of yearlings do not aim to have them ripe at this age, but rather to have them in a nice sappy condition, so that they will go on well and come back as 2-year-olds in prime form. Thus the methods of feeding practiced are such as will have a tendency to produce good growth and uniform development during the first 12 months, a continuation of growth with a slight increase in flesh during the second 12 months, some growth and a fair amount of flesh during the next 6 months, and then an abundance of good firm flesh combined with a tendency to ripen during the next 5 months, so that the animal will have sufficient size and a wealth of smooth, mellow flesh at show time.

The calves are allowed to suckle their dams or nurse cows during the first 9 or 10 months and are fed, in addition, some sliced turnips or swedes and fine hay during the winter months and grass during the summer season, with some crushed oats, ground barley, and linseed cake. The amount of grain and cake fed is not large, as good growth combined with a fair amount of flesh, not fat, is sought for. From weaning time on they are fed on hay, turnips, and a grain mixture of linseed cake, crushed oats, wheat bran, and ground barley or corn meal. This ration is continued until grass season. The method of feeding then varies, as those animals which are to be shown as yearlings are fed heavier grain and cake rations than those which are not to be shown until 2 years old.

Yearlings intended for show purposes are also housed a great deal of the time, while the others are allowed to run in grass and are fed in addition some grain and cake. Those intended for show yearlings are fed more grain and cake, also mashes and steamed or cooked food. The amount fed is varied to suit the needs of the animal and is regulated by the eye of the feeder, as a rule, and not by set standards. During the fall months roots and hay are fed in conjunction with a grain and cake mixture composed of linseed cake, crushed oats, wheat bran, ground barley, corn meal, and perhaps a little pea meal or bean meal. These methods of feeding are continued until show time. A great deal of attention is given to the question of exercise, which is either furnished by allowing the animals a few hours each day in a paddock or grass lot or by being walked for a half an hour or more by an attendant.

It is the feeding of the 2-year-old animal that taxes the skill of the feeder. The majority of the feeders aim to have their animals make good growth and gradually gain in flesh until the month of May. From this time until the middle of August the rations are gradually increased and grass and other green food is fed to purify the blood and cool the system. From the middle of August until snow time the animals are forced to their utmost capacity. Those who commence heavy feeding at an earlier date experience difficulty, as their animals are likely to be overdone, while those who commence at a later period find it very difficult to have weight and flesh enough at show time. While the different feeders use somewhat different combinations of feeding stuffs in the feeding of their cattle, still the list from which the selections are made is not very wide.

During the fall, winter, and early spring months for roughage the various kinds of hay are used; for succulent food either yellow turnips or swedes are fed, and for the concentrated part of the ration linseed cake, wheat bran, crushed oats, ground barley, corn meal, pea meal, and bean meal in some combination, are fed by the best feeders. Some feeders steam or cook all of

the grain and mix it with cut hay and pulped roots in preparation for feeding. Others prefer using all feeding stuffs in their natural state until the last few months, as by so doing they are able to make their animals eat more food when it is most needed. The amount of feed is regulated by the appetite of the animal, but the amount given is always a little less than the animal will eat, as all are very careful to avoid overfeeding so early in the season.

Regular exercise is provided at all times. During the months of May, June, and July the methods of management differ. Some very successful feeders leave their animals on grass a great deal of the time. When managed in this manner they get plenty of fresh air, succulent food, and exercise, which keeps them good on their feet and legs. Others equally as successful feeders stable their cattle from the middle of May until show time, and the only exercise they get is a half hour or more each day, when they are led out and walked by an attendant. In either instance the animals are fed a liberal grain ration which is composed of those feeding stuffs, such as crushed oats, ground barley, wheat bran, and linseed cake, which are not inclined to produce a heated condition of the system. On account of their heat-producing tendencies many feeders do not use corn meal, bean meal, or pea meal during the warm weather.

From August until show time the animals are fed on those feeding stuffs which will produce an abundance of firm flesh. For this purpose corn meal, barley meal, bean meal, pea meal, and crushed oats are very generally fed. Some linseed cake is also given, but its liberal use is claimed by many feeders to produce soft flesh. For firming up the flesh bean meal, pea meal, and crushed oats are claimed to be the most useful grains. Both the bean and pea meal should be at least one year old to insure good results. Roots are also fed; yellow turnips at first, but swedes are always fed as soon as they mature enough for feeding purposes, which is usually about the latter part of September or the first of October. The amount of succulent food is gradually reduced as the show season approaches, so that the animal will not be carrying too much belly. For roughage mixed hay, rye grass or clover hay is fed. Many feeders cut all the hay during the last month to reduce the amount of belly on the animal.

The best feeders all feed their animals at least four times per day and in many instances more frequently. During the last two months a great deal of time is spent in the cutting, steaming, and mixing of the feeding stuffs so as to make them more palatable, thus inducing the animal to eat more food. For this purpose treacle is used by nearly all of the feeders to sweeten the food, thus rendering it more palatable. A great deal of care is taken to keep the system cool and the blood pure. For this purpose a very successful feeder gives each of his show animals one-half an ounce of crude carbolic acid in a bran mash once a week during the last four months' feeding. All feeders emphasize very strongly the importance of regular exercise, especially the leading of the animal for half an hour or more each day, claiming that it aids very materially in the uniform development of firm flesh on all parts of the body.

Very complete information was secured pertaining to the methods of feeding practiced in the bringing out of all the most successful prize-winning cattle from Scotland at the leading British shows in 1904. As the methods were not very different, all the points of difference being mentioned in this connection, just one report will be given—that of the Shorthorn heifer Jewel, first in class, champion of the breed, and champion animal of any age or breed at the Smithfield Fat Stock Show in 1904, the very highest court of appeal in Great Britain.

During the months of December, January, and February, the daily ration was composed of 70 pounds turnips, 6 pounds cut rye grass hay, 3 pounds bran, 2

pounds ground barley, 1 pound bean meal, 1 pound pea meal, 2 pounds linseed cake, and 2 pounds of Thorley's cake. For the months of March, April, and May, the daily ration was composed of 70 pounds swedes, 7 pounds cut rye grass hay, 4 pounds bran, 1 pound bean meal, 1 pound pea meal, 3 pounds ground barley, 2 pounds linseed cake, and 2 pounds of Thorley's cake. During the months of June, July, and August, the daily ration was composed of green rape and tares, 7 pounds cut rye grass hay, 2 pounds bran, 1½ pounds bean meal, 1½ pounds pea meal, 4 pounds ground barley, 2 pounds linseed cake, and 2 pounds of Thorley's cake.

The September daily ration was composed of 40 pounds of yellow turnips, 30 pounds cabbage, 2 pounds bran, 2 pounds bran meal, 2 pounds pea meal, 3 pounds ground barley, 3 pounds Thorley's cake, and 1 pound linseed cake.

October daily ration was composed of 40 pounds yellow turnips, 30 pounds cabbage, 1 pound bran, 2 pounds bean meal, 2 pounds pea meal, 3 pounds ground barley, 3 pounds Thorley's cake, and 1 pound of oatmeal.

November daily ration was composed of 30 pounds yellow turnips, 30 pounds cabbages, 1 pound bran, 2 pounds bean meal, 2 pounds pea meal, 4 pounds finely ground oats, and 3 pounds of oatmeal.

During the first 6 months the heifer was fed four times per day; 6 a. m. cake, turnips, and hay; 10 a. m., mash, hay, and turnips; 4 p. m., cake, hay, and turnips; and at 7.30 p. m., mash, hay, and turnips.

During the months of June, July, and August, five times per day; 6 a. m., cake, hay, and green food; 9.30 a. m., mash, hay, and green food; 1 p. m., mash, hay, and green food; 4 p. m., cake, hay, and green food; and at 7.30 p. m., mash, hay, and green food.

During the months of September, October, and November she was fed five times per day; 6 a. m., cake, hay, and turnips; 9.30 a. m., mash, hay, and cabbage; 1 p. m., mash, hay, and turnips; 4 p. m., cake, hay, and cabbage; and at 7.30 p. m., mash, hay, and turnips.

THE UTILIZATION OF DAIRY BY-PRODUCTS AS FOOD.[1]

The important by-products of the dairy are skim milk, buttermilk, and whey, the aggregate value of which is enormous. At least 1,600,000,000 pounds of butter are made every year in this country. It is estimated that the skim milk and buttermilk resulting from the manufacture of this amount of butter contain in the aggregate over 1,000,000,000 pounds of protein, 60,000,000 pounds of fat, and 1,600,000,000 pounds of milk sugar. The whey produced in the cheese factories of the United States probably amounts to over 3,000,000,000 pounds, containing 31,000,000 pounds of protein, 9,000,000 pounds of fat, and 186,000,000 pounds of milk sugar. It is estimated that for each 100 pounds of whole milk used in butter making there are obtained as by-products 84 pounds of skim milk, containing 2.85 pounds of protein, 0.25 pound of fat, and 4.28 pounds of milk sugar. For each 100 pounds of 25 per cent cream used in

[1] Compiled from New York Cornell Sta. Bul. 85; Vermont Sta. Bul. 155; Wisconsin Sta. Buls. 132, 211, Rpt. 1895, p. 134; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 146, Circ. 161; Ontario Agr. Col. and Expt. Farm Ann. Rpts., 32 (1906), p. 308; 34 (1908), pp. 110, 147; 35 (1909), p. 124; Ontario Dept. Agr. Bul. 183; New England Farmer, 90 (1912), No. 54, p. 15.

butter making there are obtained 65 pounds of buttermilk, containing 1.95 pounds of protein, 0.32 pound of fat, and 3.12 pounds of milk sugar. For each 100 pounds of whole milk used in cheese making there are produced 90 pounds of whey, containing 0.9 pound of protein, 0.27 pound of fat, and 4.5 pounds of milk sugar. These by-products are imperfectly used at the present time.

As pointed out in previous bulletins of this series,[1] more use is made of the skim milk, which is now largely used on the farm and fed to calves, hogs, and poultry, and to a less extent used as human food. Considerable use is also made of skim milk for the preparation of casein used in the manufacture of various articles, and this use will probably increase. Large amounts of skim milk are used in the manufacture of cheese, condensed milk, sour-milk drinks, etc. It is safe to say, however, that thousands of dollars are annually wasted in many creameries and cheese factories because the buttermilk and whey are thrown away or put to inferior uses. In view of the high cost of foodstuffs of all kinds it is imperative that such valuable foodstuffs as these should not be wantonly wasted. A German authority states that under conditions in that country 25 cents will buy 538 food units in form of beef, 552 in poultry, 1,615 in whole milk, 2,311 in buttermilk, and 2,562 in skim milk. It is the purpose of this bulletin to point out especially some of the various ways in which buttermilk and whey may be utilized as human food.

UTILIZATION OF BUTTERMILK.

Buttermilk as a Beverage.

Buttermilk is a tempting beverage to many persons and when obtained as a by-product in butter making has a quality and flavor superior to the skim-milk buttermilk described in a previous bulletin of this series.[2] As a beverage the use of buttermilk in this country is increasing, for already in large cities there is a good demand for buttermilk in hotels, at lunch counters, and in bar rooms. It is reported that in some European cities buttermilk is to some extent replacing beer. An ordinary glass of buttermilk contains about as much nutriment as 2 ounces of bread, a good size potato, or a half pint of oysters.[3] The chemical composition of buttermilk varies more or less according to the composition of the milk from which it is made, but on the average it contains about the following percentages: Water, 91; protein, 3; fat, 0.5; carbohydrates, 4.8; ash, 0.7 per cent. It thus contains about the same food constituents as skim

[1] U. S. Dept. Agr., Farmers' Buls. 84, pp. 20, 21, 22; 92, p. 21; 133, p. 28; 202, p. 28; 233, p. 22; 381, p. 14; 384, p. 18. 405, p. 14; 430, p. 9; 457, p. 21.

[2] U. S. Dept. Agr., Farmers' Bul. 384, p. 406.

[3] U. S. Dept. Agr., Farmers' Bul. 363, p. 40.

milk, but it has an added hygienic value because the protein is more easily digested than the protein in skim milk, and therefore is often prescribed by physicians for children and invalids, especially those suffering from intestinal trouble.[1]

Protein being the most costly of food ingredients is the one most likely to be lacking in inexpensive meals, and this is the nutrient which both skim milk and buttermilk supply in a cheap and useful form, and when taken with bread or used in cooking they form a very nutritious addition to the diet. Two and one-half quarts of skim milk or buttermilk contains about the same amount of protein as 1 pound of round steak, and costs about one-quarter as much. Two quarts of the milk has a greater nutrient value than 1 quart of oysters. The nutriment in the form of oysters would cost 30 to 50 cents, while the skim milk or buttermilk would have a value on the farm of from 2 to 4 cents.

Buttermilk Cheese.

Because buttermilk can not be made into cheese by the same methods used in making cottage cheese, the utilization of pure buttermilk for cheese making has until recently been regarded as impossible. Mixtures of skim milk and buttermilk are much easier to handle for making cheese than pure buttermilk, but the practical objection to the use of such a mixture is that every year fewer creameries have any skim milk, the separating being done on the farm.

In a recent bulletin of the Wisconsin Station, J. L. Sammis calls attention to the unnecessary waste of buttermilk and describes, for the first time, a method by which cheese can be made from the pure buttermilk, which has about the same value pound for pound as lean beefsteak, which sells at twice the price. Large numbers of city residents, to whom the prices of meat and eggs are objectionably high, should find in this cheese a palatable and economical food. The cheese can be eaten alone like cottage cheese, or it can be seasoned with salt, pepper, and paprika, or mixed with chopped pickles, olives, and nuts. It can also be used in salads. On account of its smooth texture it can be spread on bread like butter and can be used in sandwiches, either with or without butter. Bakers prefer buttermilk cheese on account of its smooth texture for the same purposes for which they formerly used cottage cheese.

The method of making this buttermilk cheese is described as follows:

> If the acidity of the buttermilk is as high as 0.5 per cent or higher when drawn from the churn, it will curdle properly after heating to 80° F., as directed below. If the buttermilk shows only 0.4 per cent acidity it will require to be heated to 90° instead of 80° to produce curdling. * * *

[1] Jour. Amer. Med. Assoc., 48 (1907), p. 1576.

The buttermilk is run directly from the churn into any convenient container to which heat can be applied. The wash water from the butter is not added. A steam-heated cheese vat, cream ripener or starter can is suitable. A tin-lined cream vat or an old weighing can (if free from rust) may be used, but it is necessary to provide a heating coil, made of two or three turns of one-half inch galvanized steam pipe. * * * Any container too heavy to tip to pour out the whey and curd should be provided with a gate for an outlet. On a small scale, a pail, a shotgun can, a new wash boiler, or any milk can, heated in a tub of hot water, can be used. No rennet is needed in making buttermilk cheese.

As soon as the buttermilk is in the vat, and usually before the butter is salted, it is convenient to heat the buttermilk to 80° as rapidly as possible, stirring enough to insure even heating of the vat contents. Then leave the vat undisturbed for about an hour, * * * as it needs no attention during this period of coagulation. The curd collects in a mass, surrounded by clear whey, and may float near the top or settle partly or wholly to the bottom, but the position of the curd is of no consequence.

Steam is now turned on and the vat heated rapidly to 130°, stirring enough to insure even heating. If desired to pasteurize the material, it may be heated to 140° or 150°. It is then left undisturbed for about an hour until the butter maker can spare a few minutes time to put the curd on the draining rack. It is well to keep the vat covered after the second heating in order that it may cool as little as possible, since the curd drains faster if warm, when put on the rack, than if cold It should not be reheated or stirred again before draining. The draining rack can be constructed by any carpenter, and is described below.

After the vat has stood at 130° to 140° for about an hour the draining cloth is placed in the rack, and this is pushed under the gate of the vat, which should stand near the floor drain. Upon examination of the vat contents, it will be found that the curd has shrunk in bulk, and has collected in a mass which is either floating at the surface or has settled entirely to the bottom. The next operation is to transfer the curd with as little whey as possible to the draining rack below the gate. This may be done in two ways.

First, if the curd is floating with clear whey beneath, upon opening the gate of the vat, the whey will run out first into the draining rack through the cloth and into the drain in the floor below, through which it can be drawn into the whey tank. As the whey runs out the layer of curd settles and finally runs through the gate and is caught in the cloth. By this means it is easy to get rid of most of the clear whey first and put the curd on the draining rack in the form of a thick mush. It is well to set a small pan under the gate on the draining cloth to prevent the curd from beating through the cloth at the place where it falls.

Second, in case the curd in the vat has settled to the bottom, leaving the whey above, it is best to put a strainer and siphon into the vat and draw out as much as possible of the clear whey without disturbing the curd. Afterwards the gate is opened and the curd, with the small amount of remaining whey, is run on to the draining rack.

In either case as soon as the curd is all on the rack it is covered and left undisturbed for half a day or over night to drain.

A most important factor in the success of the buttermilk cheese business is to see that the curd is drained equally dry, so as to appear of uniform consistency, day after day. * * * The portions of curd nearest the cloth drain most rapidly and may become quite dry while there is yet some whey standing

on top of the curd, as shown in figure 1 at A. To observe this layer of dry curd next the cloth and also to hasten the draining the maker may lift up the cloth at one end of the vat, as shown in figure 1 at B. This will cause the dry curd to peel off clean from the cloth and settle in a pile in the middle of the rack. Lowering the cloth into place again will allow the loose whey to run down over the clean cloth surface and drain through more rapidly. The cloth should be raised at the other end of the rack also and the curd rolled into a pile at the middle, as shown in figure 1 at C.

As long as the curd is so moist that it will flow like a thick mush when the corner of the cloth is raised, it is too moist to suit the taste of most people. A well-drained curd can be taken out of the draining rack in large flat cakes, which retain their shape. If too moist the curd flows like wet mortar, and if too dry it crumbles apart when lifted. It should aways be drained dry enough before packing, so that there is no danger of whey separating from the curd in the package or danger of the product leaking out when the container, such as a covered butter tub, for example, is inverted. When properly drained the mass of curd can be taken out of the draining rack and molded with paddles into a tall form without losing its shape. * * * A curd would much better be drained longer than necessary rather than not long enough, because if too dry the consumer or maker can at any time easily restore the desired consist-

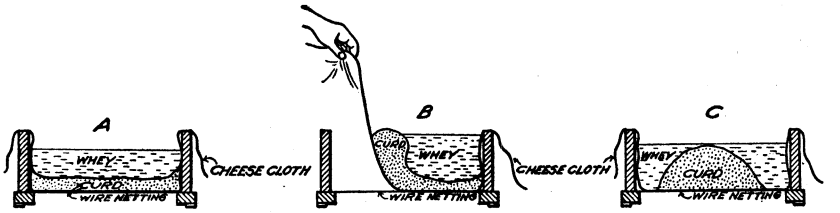

FIG. 1.—Three stages of the draining process. At *A* the curd is lying on the cheese cloth in the bottom of the draining rack; at *B* the cloth is lifted on one side to pile the curd in the center of the rack; and at *C* the operation is completed.

ency by stirring in a little clean water, milk, or cream. On account of the smooth texture and fine buttermilk flavor of this product, it is not customary for the maker to add any cream to it, as it is necessary to do with skim-milk cottage cheese. The drier the curd the harder it is to stir in salt.

As soon as the curd is properly drained it is salted and packed immediately. The weight of salt needed is calculated either from the estimated weight of the buttermilk used or from the weight of the curd itself, which can be determined by lifting the curd altogether in the draining cloth and setting it on the platform scales. Use 1¼ to 1½ pounds of salt for 100 pounds of curd obtained, or for 800 pounds of buttermilk used. Weigh the salt carefully. Break up any lumps and sprinkle about half of the salt over the curd on the cloth in the rack. Stir it in well. Roll all of the curd over by raising the cloth at one side of the rack. Add the rest of the salt and stir in thoroughly. It is important that every pound of curd sold to consumers contain its proper proportion of salt.

Curd can be packed in lined or paraffined butter tubs for shipment or placed in a milk can in the refrigerator for local trade. When delivered in tubs or tin pails to retailers the main portion should be kept in a refrigerator, but a 1 to 5 pound sample should be put in transparent covered glass vessel, such as a pickle jar, on the counter, where customers can see and sample it. It should be plainly labeled, "Buttermilk cheese." For delivery to consumer in 1 or 2

pound lots it may be weighed into paper pails such as are used everywhere for oysters or ice cream, or into the neat paraffined paper single-service containers, * * * which are now obtainable, and which do not absorb moisture. It can be packed in cartons like butter prints.

The special apparatus used for making buttermilk cheese on a large scale, which is described in the bulletin, is inexpensive, and can be made by almost any butter maker. When only a small quantity is made daily the ordinary utensils of the creamery can be used.

Where only a few pounds of buttermilk cheese are made at a time, as on a farm or for home use, the buttermilk can be heated in a pail or in a clean new wash boiler on the stove. After the second heating, i. e., to 130°, if the curd has settled, the whey can be mostly poured off by tipping the pail, and the curd poured into a small cheesecloth bag to drain. If the curd is floating, it can be dipped off of the surface of the whey with a dipper or large spoon and put in the bag to drain. A small wooden draining rack a foot square and 5 or 6 inches deep, with the bottom made of one-fourth of an inch mesh gal-

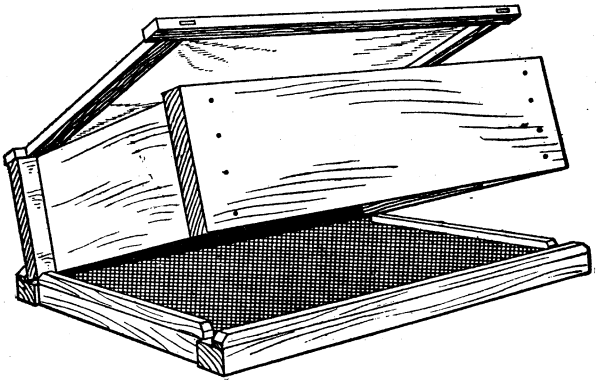

FIG. 2.—A draining rack suitable for a large creamery.

vanized or tinned iron wire netting and covered with cheesecloth, is useful for draining small amounts of buttermilk cheese, and for many other purposes in the household. * * *

A more substantial draining rack for use in a large creamery is shown in figure 2, and can be made in the following manner: Make a square frame with mortised joints of 2 by 4 inch dressed lumber and fasten the wire netting on top with staples. This is the bottom of the draining rack. A little strip of molding is put around the outside of this frame on top to prevent the upper half from slipping out of place. The upper half is made of 2 by 12 inch dressed lumber mortised and spiked at the corners. A light wooden frame made out of 1 by 2 inch lumber with muslin or duck tacked on forms the lid for the draining rack. The wooden parts should be given 2 to 3 coats of linseed oil before being used, to prevent the absorption of water.

A piece of good quality cheesecloth is used to cover the sides and bottom of the rack and to hold the curd while draining. If it is necessary to sew two widths of cloth together, lap the edges about 1 inch and sew two seams about half an inch apart along the lap. * * *

Some kinds of butter color impart a faint color to the buttermilk and also to the cheese made therefrom. If a deeper color is desired in the cheese, this

may be obtained by adding cheese color, such as used by Cheddar cheese makers, to the buttermilk before it is heated to 80°. One-half ounce of cheese color or more per 1,000 pounds of buttermilk may be used. * * *

If, for any reason, it is desired to make a very moist cheese from buttermilk, this can be done by proceeding exactly as directed above, but draining the curd for a shorter time until the desired consistency is reached and then salting and packing immediately. * * *

In addition to ordinary cleanliness it is entirely practicable to pasteurize the raw material used for making buttermilk cheese. Either the cream may be pasteurized before churning or the buttermilk may be heated to a pasteurizing temperature, 140°, for an hour during the cheese making process. Such pasteurization is sufficient to kill disease germs such as those producing tuberculosis, typhoid fever, dysentery, etc. * * *

Sold at 3 cents a pound, the 12 pounds of cheese obtained from 100 pounds of buttermilk add 36 cents to the income of the creamery, with an expense of less than 2 cents for steam, salt, etc., used in making. The time of the butter maker is not included here, because less than an hour per day is needed when the cheese is made daily either in large or small lots, and also because the work requires only 5 to 10 minutes at a time at convenient intervals during the day. * * *

Buttermilk from rich cream containing 50 per cent or more fat, as well as buttermilk from cream which was pasteurized when very sour, is not suitable for making buttermilk cheese. The curd from such buttermilk is always so fine grained that it runs through the draining cloth and is lost.

This cheese should find a ready sale among the foreign population of our cities, and even among the natives, when the cheese is sufficiently advertised to bring it to their attention. It ought to make a good grated cheese for cooking purposes.

PART BUTTERMILK CHEESE.

It is a common practice in European countries to mix buttermilk with skim milk or whole milk in making cheese of certain types. The methods of making varieties of such cheese are described by Doane and Lawson in a bulletin of the Bureau of Animal Industry as follows:

Hand Cheese.—Hand cheese is so named because it was molded originally into its final shape by hand. It is a sour-milk cheese, very popular among German races and manufactured in many countries.

The process of making varies in different localities, but in general is about as follows: The skimmed milk is mixed with buttermilk and put into a tinned vessel, where it is held at a favorable temperature for souring. When thick the curd is broken up by stirring and heated to 120° F. The cooking is continued for about 3 hours and for the first hour of this time is stirred thoroughly. After cooking the whey is drained off and the curd is put in a mold for cooling. It is then ground fine in a curd mill and salt is incorporated, and for some kinds caraway seed is added. The curd is then pressed into the desired shapes and sizes. The small cheeses are dried in a warm room and then transferred to the curing cellar, where they are kept on shelves until the ripening on the surface has commenced, when they are packed in boxes. The cheese has a very

sharp, pungent odor and taste, which to most people unaccustomed to it is very disagreeable.

There are many local names for hand cheeses, among which are the following: Thuringia caraway cheese; Ihlefeld, made in Mechlenburg; Livlander, made in Russia; Olmützer Bierkäse; Dresdener Bierkäse; Satz, made in Saxony; Tyrol sour cheese; Berliner Kuhkäse, and Alt Kuhkäse.

Leather Cheese.—A method of utilizing creamery by-products in Schleswig-Holstein is in making a skim-milk cheese containing 5 to 10 per cent of buttermilk, the product being known as leather, leder, or Holstein dairy cheese.

The milk is set at from 95° to 100° F., and requires 25 to 35 minutes for coagulation. It is then broken up with a harp or a stirring stick, and is stirred with a Danish stirrer. When the particles are reduced to the size of peas the curd is piled up on one side of the vat or kettle and allowed to stand for 10 minutes. The whey is then dipped off. The curd is cut with a knife into pieces the size of the hand, put in a wooden or tin bowl, and pressed for one-half hour, when it is cut into pieces and run thorugh a cheese mill. It is then salted, put in a cloth, and again put in the press, where the pressure is gradually increased. The cheese is turned occasionally and a fresh dry cloth supplied. After 12 hours of pressing the cheese is put into the salt bath, where it is kept 40 to 48 hours. It is then transferred to the ripening cellar, where it is wiped with a dry cloth every day for about a week and thereafter twice a week, the ripening requiring about 4 months. The cured cheese has small eyes; it is made cylindrical, and is 4 to 6 inches in height and 10 to 12 inches in diameter. It weighs 15 to 25 pounds.

Danish Export Cheese.—This cheese is made in some of the creameries of Denmark to furnish an outlet for the skim milk and the buttermilk. In the process of manufacture as high as 15 per cent of fresh buttermilk is added to the skim milk. The mixture is set at 98° F. with sufficient rennet to coagulate in 25 minutes. The curd is carefully and evenly cut, stirred for a few minutes, dipped into forms having rounded bottoms, kneaded, pressed down, and finally covered with a board, upon which a weight is placed. Twelve hours later the cheeses are placed in a brine tank for 24 hours, when they are taken out and covered with salt for a short time. They are then transferred to the ripening room, where the temperature is about 55°, and are turned and wiped with a cloth every day for 5 weeks. The cheeses are cylindrical in shape and are small and flat.

Manur Cheese.—This cheese is made in Servia from either sheep's or cow's milk. The milk is first heated to the boiling temperature and then cooled until the fingers can be held in it. A mixture of buttermilk and fresh whey with rennet is added. The curd is lifted from the whey in a cloth and allowed to drain, when it is kneaded like bread, lightly salted, and dried.

Pultost Cheese.—Pultost, also called Knaost, is made usually from sour milk, but it may be made with rennet. It is a Norwegian product, and is made in private dairies in the mountains of that country. The milk is placed in a kettle and if not sour enough to coagulate on warming the acidity is increased by the addition of buttermilk. When sufficient acid has developed the milk is warmed to 113° F. The curd is broken up with a scoop and stirred to keep it from matting together while it is being heated to 140°. It is then dipped and ground up fine. Buttermilk is added and the whole is thoroughly kneaded and put into troughs, where it is covered with a cloth. It is allowed to stand for three days with occasional stirring.

Sap Sago Cheese.—Sap Sago is a small, hard, green cheese flavored with the leaves of a species of clover; it is shaped like a truncated cone, 4 inches high, 3 inches in diameter at the base, and 2 inches at the top. * * *

The skimmed milk from which this cheese is made is not allowed to become sour enough to coagulate on heating, as it would make too hard a curd. The milk when it has reached the right acidity is heated to the boiling temperature while being stirred. Cold buttermilk is then added, as is also some whey having a high percentage of acidity. The material coagulating on the surface is skimmed off. The milk is then stirred while sufficient acid whey is added to precipitate the casein. When too little whey is used the curd is too soft, and when too much is used it is too hard. The curd is dipped with a skimmer and spread out to cool and then put in boxes and allowed to drain and ferment. The box is kept at a temperature of about 60° F., and pressure is applied by weighting with stones. Ripening is allowed to continue for 3 to 6 weeks. If the temperature of the room is too high or there is not sufficient pressure, too rapid and strong fermentation results. This curd is used for making the finished product, but the cheese is seldom finished where the curd is made. The curd is ground in a mill, and every 100 pounds of cheese contains 5 pounds of salt and 25 pounds of dried *Melilotus cærulea*, an aromatic clover which is grown in the Canton of Schweiz for the purpose. The ground material is worked up into a dough and is forced into molds lined with linen cloth, and the name of the manufacturer is stamped on the large end. The mold is then emptied and refilled. The cheeses are dumped promiscuously into a large cask holding about 200 pounds. A comparatively small quantity is shipped into this country. It sells at a low price and is usually grated.

It should be possible to use buttermilk as well as skim-milk cheeses to take the place of Parmesan and similar cheeses, some of which are imported in large quantities and sell for high prices.

Buttermilk Cream.

The preparation of buttermilk cream is described by J. L. Sammis, of the Wisconsin station, as follows:

Buttermilk cream has the consistency of ordinary thick cream and [is] quite smooth and free from lumps or grains. It is made in the same general manner as described for buttermilk cheese, but with this difference, that at the second heating the temperature is raised only to 100° instead of 130°. The curd is put to drain at this lower temperature and therefore drains more slowly. Too long heating or use of too high a temperature before draining makes the drained product dry and granular. Before packing for sale, the buttermilk cream taken from the draining cloth should be stirred up well to give it a uniformly smooth appearance. * * *

For some time the buttermilk was made into buttermilk cream at the Wisconsin station and offered for sale alongside of the regular buttermilk cheese, and it was observed that the great majority of consumers chose the "cheese" rather than the "cream." Consequently the making of buttermilk cream was discontinued.

Condensed Buttermilk.

Condensed buttermilk is made to some extent in Europe and ought to become an important commercial food product. It is sometimes also sold in powdered form.

Buttermilk Sherbet.

Buttermilk sherbet is considered a delicacy by some, and is a valuable dish for invalids. R. M. Washburn, of the Vermont station, states that—

> This new dish has merit and should become popular, especially in warm weather. It is made very much as are other sherbets, except that fresh, tart buttermilk is used in place of water, no lemons or other acid-bearing ingredient being required. Made in a small way, the following recipe has been found to give excellent results: Two quarts fresh, tart buttermilk; 1¼ pounds sugar; 1 large orange or 2 small ones; 3 teaspoonfuls gelatin. It is frozen in the same manner as is ice cream, save that no attempt is made to increase its volume materially. This sherbet is so rich in sugar that it will melt at a relatively low temperature, and consequently it will often be found slushy if held at the ordinary holding temperature for ice cream.

UTILIZATION OF WHEY.

Whey, the residue from cheese making, is used to some extent as food for man and beast and for various purposes in the arts. Chemical analysis of whey shows that on an average it has about the following composition: Water 93 per cent, albumin (protein) 1 per cent, fat 0.3 per cent, and carbohydrates (sugar) 5 per cent. Although containing considerable nutritive material, whey has less food value than skim milk or buttermilk, but is occasionally useful as a mild laxative drink for invalids. Its dietetic value is more fully recognized in Europe than in this country. In Finland whey is mixed with water or milk and used as a drink for man or beast, but in the United States in many cheese factories the whey is allowed to go to waste. Of the 3,000,000,000 pounds or more of whey annually produced in the United States only about 166,000,000 pounds are reported to be utilized. In some localities whey is used for feeding pigs. Sometimes the whey is evaporated, and the sugar thus obtained is sold to the trade. The residue from the sugar has value as a fertilizer and has been used for this purpose. Occasionally the whey is run through a separator and the fat obtained is made into whey butter.

Whey Butter.

The manufacture of butter from the fat in whey as a by-product in cheese making is a common practice in Europe, but has been undertaken in only a few factories in the United States, although experiments at the Cornell and Wisconsin stations by the Dairy Division of this department have shown that it is profitable to do this in a large plant when butter is high in price. The results of the experiments of the dairy division of this department in making whey butter at a Wisconsin cheese factory may be summarized as follows:

The yield of butter for different months varied within comparatively wide limits. For June it was 2½ pounds per 1,000 pounds of

milk, while for October it was 3½ pounds. The daily variation was even greater, varying from 2 to 5 pounds of butter per 1,000 pounds of milk. To secure the maximum yield it was necessary to save the drippings from the milled curds. In one instance 58 pounds of whey, which tested 11 per cent fat, dripped from the milled curd of a 5,000-pound vat of milk.

In making whey butter it was found to be the best practice to run the whey directly from the vats to a thoroughly sanitary tank and separate with as little delay as possible. A pump is necessary for elevating the whey from the tank to the separator. It is believed that from 20 to 30 per cent of starter improves the flavor. The butter made from whey is better than a large part of the butter commonly sold to retail trade, but the drippings from the milled curd give the butter a characteristic flavor somewhat difficult to describe, which brings down the theoretical score, although it does not seem to injure the butter for table use. Whey butter is apparently a little softer than the regular creamery butter, but a number of tests showed that this was not due to excessive moisture. The butter sold to the local trade brought a little less than the best creamery butter, while the portion shipped to Chicago sold for 2 to 3 cents under the regular price for creamery butter.

It is thought that for factories having a maximum daily run of 10,000 pounds or more the making of whey butter would be a profitable undertaking for both the factory and the farmer. A cheese factory in which the Dairy Division of this department has been interested paid to the farmers about $1,000 for their share of the butter in one year, and this sum was a clear gain to the farmers. In addition to this, it is pointed out that the patrons of the cheese factory can buy the butter at a lower price than creamery butter shipped in and retailed from local stores.

At the Ontario Experiment Station the average yield of butter per 1,000 pounds of whey was about 2½ pounds, and it is thought that it is profitable to make whey butter only in large factories or where conditions are favorable for centralizing the whey cream. The quality of the butter was fair and possessed fairly good keeping qualities; in fact, it was equal to average creamery butter when the whey was pasteurized; but that made from unpasteurized cream and allowed to ripen naturally was poor in quality and went off in flavor badly at the end of six months. The grain and color of the pasteurized lots seemed to improve with keeping.

Albumin or Whey Cheeses.

In European countries the albumin is often utilized in making whey cheese. In Scandinavia these cheeses are known under the

name of "mysost." The type generally made in southern and central Europe, known as "Ziger," is prepared as follows:

Ziger.—This is a cheese made from the whey obtained in the manufacture of other cheese. It consists principally of albumin, but where no effort is made to separate the fat from the whey the product may contain a relatively high proportion of fat. It is a cheap food product made in all the countries of Central Europe. Among the many names applied to it are Albumin cheese, Recuit, Ricotte, Broccio, Brocotte, Sérac, and Ceracee.

In the manufacture of this product an effort is sometimes made to remove the fat remaining in the whey, but in most cases the fat is allowed to remain. Where it is desired to skim the whey a small portion of very sour whey, previously prepared, is added to the sweet whey and the whole is heated to 160° to 175° F. for a few minutes, when the fat collects on the surface and can be skimmed off. Following this a greater portion of sour whey is added and the whey is then heated nearly to the boiling point, when the albumin is precipitated in a flocculent condition and rises to the surface of the whey. When the whey is not in normal condition the albumin may be precipitated in a powdery mass. This is often prevented by adding 3 to 5 per cent of buttermilk to the whey before the last heating. The casein of the buttermilk is precipitated, the albumin being carried with it. It is considered that this addition of casein injures the product. The albumin when skimmed from the whey is salted and packed in a vessel and may be covered with whey.

A so-called formed Ziger cheese is made by molding the half-dried albumin into squares which may be still further dried. Some of these have local names, such as the Hudelziger made in the Canton of Glarus, Switzerland.

In Vorarlberg the albumin is skimmed from the whey, allowed to cool, placed in cheese cloth, and subjected to increasing pressure in an Emmental cheese press. After 24 hours the cheese is put into a salt bath, to which sweet cider and vinegar are sometimes added.

A mixture of Ziger and cream prepared in the Savoy is known as Gruau de Montagne. An albumin cheese made from the whey of goat's-milk cheese in the Canton of Graubünden, Switzerland, is known as Mascarponi.

There are several cheese factories in New York and Ohio which make cheese especially for Italian trade that calls for varieties similar to those that Italians are accustomed to in their home country. One of these varieties is an albumin cheese, known to the trade as "Ricotte." It is made by utilizing the whey drawn from the curd used for making a skim-milk cheese. The whey is heated to about 200° F., and the coagulated albumin is skimmed out and put into perforated tin cylinders about 6 inches in diameter and slightly tapering. These are set one into another for pressure. The albumin block is then rubbed with salt and set on a shelf to dry for several weeks. A steam-heated kiln may be used to facilitate the drying. The cheese is then wrapped in parchment paper and packed in barrels for shipment.

Mysost.—Mysost is made from whey and is a product of Norway, Sweden, and Denmark, and to a very limited extent of the United States. It has a light-brown color, a buttery consistency, and a mild, sweetish taste.

The method of manufacture is as follows: As soon as the curd of the regular cheese is removed from the whey, the whey is strained and is put in a kettle or large pan over the fire and the albuminous material which rises to the surface is skimmed off. The whey is evaporated as rapidly as possible with constant and thorough stirring. When it has reached about one-fourth its original volume the albumin previously skimmed off is returned and stirred thoroughly to break up all possible lumps. When the whey has attained the consistency of thickened milk it is poured quickly into a wooden trough and stirred with a paddle until cool to prevent the formation of sugar crystals. This can then be molded into the desired form. In this country it is usually made into cylindrical shapes and wrapped in tin foil.

In recent years it has become the custom to add some cream to the whey cheese to make it considerably richer in fat and casein. This new variety is called "fetost."

For a full discussion of the nutritive value and place in the diet of milk and its products the reader is referred especially to Farmers' Buls. 363 and 487 of this department.

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